(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 804 907 B1

(12) EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention of the grant of the patent:
23.11.2005 Bulletin 2005/47

(51) Int Cl.[7]: **A61F 2/06**, A61M 29/00

(21) Application number: **97107358.0**

(22) Date of filing: **05.05.1997**

(54) Bifurcated stent and system for forming same

Abzweigender Stent und System für seine Erzeugung

Stent à deux branches et système de réalisation

(84) Designated Contracting States:
AT BE CH DE DK ES FI FR GB GR IE IT LI LU NL PT SE
Designated Extension States:
LT RO SI

(30) Priority: **03.05.1996 US 642297**

(43) Date of publication of application:
05.11.1997 Bulletin 1997/45

(60) Divisional application:
00114957.4 / 1 040 795

(73) Proprietor: **MEDINOL LIMITED**
Tel Aviv 61581 (IL)

(72) Inventors:
- **Richter, Jacob**
  Tel Aviv 61581 (IL)
- **Pinchasik, Gregory**
  Ramat Hasharon 47414 (IL)

(74) Representative: **Altenburg, Udo et al**
Patent- und Rechtsanwälte
Bardehle . Pagenberg . Dost .
Altenburg .Geissler
Galileiplatz 1
81679 München (DE)

(56) References cited:
EP-A- 0 944 366
EP-A2- 0 686 379
WO-A1-95/21592

EP 0 804 907 B1

Description

Field of the Invention

[0001] The present invention relates to stents, and more particularly to bifurcated stents.

Background of the Invention

[0002] Stents are well known in the art. They are typically formed of a cylindrical metal mesh which can expand when pressure is internally applied. Alternatively, they can be formed of wire wrapped into a cylindrical shape or sheets of material formed into a cylindrical shape.

[0003] Stents are devices which are usually implanted within bodily conduits including the vascular system to reinforce collapsing, partially occluded, weakened, or abnormally dilated sections of the blood vessel. Stents also have been successfully implanted in other areas, e.g., the urinary tract or the bile duct to reinforce such bodily conduits.

[0004] U.S. Patent No. 4,994,071 (MacGregor) discloses an expandable, bifurcating stent having a main cylindrical lattice formed from interconnected, flexible wire loops. Two additional cylindrical lattices, having smaller diameters than the main lattice, are similarly constructed. The main lattice includes a flexible wire interconnecting the main lattice to one of the additional lattices. A second flexible wire interconnects the main lattice to the other additional lattice. The flexible wires form backbones that extend axially along the length of the main lattice and along each of the additional lattices. One disadvantage of this bifurcating stent is the complex nature of the interconnection of the flexible wires forming the backbones with the loop structure of each lattice.

[0005] WO-A-95 21592 discloses a bifurcated endoluminal prosthesis comprising a first stent that has two transversely spaced female cooperating portions, each of which is adapted for connection to a male stent which, in use, extends across the bifurcation into a respective one of the branched blood vessels.

Summary of the Invention

[0006] The present invention solves these and other disadvantages of the prior art by providing a bifurcated stent and a system for forming a bifurcated stent.

[0007] The bifurcated stent comprises first and second tubular portions. The first portion has a proximal end which forms the stem portion and a distal end which forms one of the leg portions of the bifurcated stent. A branch aperture is formed in a sidewall of the first portion and disposed between the proximal end and the distal end of the first portion. The second portion is introduced into the longitudinal bore of the stem portion of the first portion and is advanced through the branch aperture so that it protrudes beyond the branch aperture to form a second leg. When the second portion is expanded, the proximal end of the second portion engages the material defining the branch aperture so as to secure the second leg in the desired position.

[0008] A method of making a bifurcated stent is described comprising the steps of a) preparing a first expandable tubular member having a proximal end and a distal end and a longitudinal bore therethrough, the first tubular member provided with a branch aperture disposed between said proximal end and the distal end, the branch aperture communicating with said longitudinal bore and the aperture sized and adapted to receive and secure a second expandable tubular member; b) delivering the first expandable tubular member to a bifurcated vessel having a first lumen and a second lumen so that the first expandable member is disposed within the first lumen and the branch aperture communicates with the second lumen; c) expanding the first expandable member in an amount sufficient to secure the first expandable member in the first lumen; d) preparing a second expandable tubular member having a proximal end and a distal end and having longitudinal bore therethrough; e) widening the branch aperture; f) delivering the second expandable tubular member into the branch aperture so that the distal end of the second expandable tubular member is disposed within the second lumen and the proximal end of the second expandable tubular member is disposed within the longitudinal bore of the first longitudinal member; and g) expanding the second expandable tubular member in an amount sufficient to secure the second expandable tubular member within the second lumen and within said branch aperture.

Brief Description of the Drawings

[0009]

FIG. 1 shows a bifurcated stent not forming part of the present invention;

FIG. 2 shows sheets used to form the legs and stem of the stent shown in FIG. 1;

FIG. 3 shows the sheets shown in FIG. 2 after they have been rolled into a tubular shape;

FIG. 4 is a perspective view of the tubes shown in FIG. 3 prior to assembly;

FIG. 5 is an end view of the tubes shown in FIGS. 3 and 4 after they have been assembled to form a stent;

FIG. 6 is a top view of the assembled apparatus shown in FIG. 5;

FIG. 7 shows sheets used to form another bifurcated stent not forming part of the invention;

FIG. 7B shows sheets used to form another bifurcated stent not forming part of the invention;

FIG. 8 shows the sheets of FIG. 7 with demarcation points;

FIG. 9 shows the sheets of FIG. 8 after they have

been rolled into a tubular shape;
FIG. 9B shows the sheets of FIG. 7B after they have been rolled into a tubular shape;
FIG. 10 shows the tubes of FIG. 9 just prior to assembly;
FIG. 10B shows the tubes of FIG. 9B just prior to assembly;
FIG. 11 is a side view of the tubes shown in FIGS. 9 and 10 after assembly;
FIG. 11B is a side view of the tubes shown in FIGS. 9B and 10B after assembly;
FIG. 12 is an end view of the assembled apparatus shown in FIG. 11;
FIG. 12B is an end view of the assembled apparatus shown in FIG. 11B;
FIG. 12C shows an alternative embodiment of a pattern that may be used in place of the patterns shown in FIGS. 7 and 7B;
FIG. 13 shows a stem and first leg portion and a second leg portion used to form a bifurcated stent manufactured in accordance with this invention;
FIG. 14 shows guide wires disposed in the trunk lumen and branch lumen to be treated;
FIG. 15 shows the stem and first leg portion shown in FIG. 13 disposed on catheters and guide wires prior to introduction into the lumen to be treated;
FIG. 16 shows the stem and first leg portion shown in FIG. 13 after it has been delivered to the bifurcation to be treated and prior to its expansion;
FIG. 17 shows the second leg portion shown in FIG. 16 after it has been expanded;
FIG. 18 shows expansion of the branch aperture;
FIG. 19 shows the unexpanded second leg portion disposed in the branch aperture;
FIG. 20 shows the expansion of the second leg portion shown in FIG. 19; and
FIG. 21 shows the assembled bifurcated stent disposed in the bifurcated lumen to be treated.

Detailed Description

[0010] The bifurcation stent 5 illustrated in FIG. 1 comprises a first leg 10, a second leg 15, and a stem 20. FIG. 2 shows a first sheet 25 which is used to form first leg 10, a second sheet 30 which is used to form second leg 15, and a third sheet 35 which is used to form stem 20. The first sheet 25 and second sheet 30 are substantially flat and are sized to a predetermined length and width. For many applications, the first sheet 25 and second sheet 30 will have substantially the same dimensions so as to produce legs 10 and 15 that are substantially the same size, however, the legs 10 and 15, and the sheets 25 and 30 used to produce them, may be of varying sizes as specific applications dictate. The stents may be sized so that when assembled they are their final size, however, in a preferred embodiment the stents are expandable and sized and adapted to assume their final dimensions upon expansion. The stent sheets 25 and 30 may be patterned or etched with perforations forming a variety of patterns as specific applications dictate to achieve the expandable features required as previously discussed. The third sheet 35 is sized so that when it is rolled into a tube its internal cross-section can be made to accommodate the cross-sectional external diameters of first leg 10 and second leg 15. First sheet 25 has a first edge 26, a second edge 27, a third edge 28, and a fourth edge 29. Second sheet 30 has a first edge 31, a second edge 32, a third edge 33, and a fourth edge 34. Third sheet 35 has a first edge 36, a second edge 37, a third edge 38, and a fourth edge 39. After the sheet metal has been cut to form sheets 25, 30, and 35, it is deformed and rolled so as to cause two opposite edges to meet and create a cylinder. In the example shown in FIGs. 2 and 3, edge 27 is joined to edge 29 via weld run 14 to form first leg 10. Edge 32 is joined to edge 34 via weld run 19 to form second leg 15. Edge 37 is joined to edge 39 via weld run 29 to form stem 20. The edges may be joined in a wide variety of ways well known to those skilled in the art as suitable for this purpose, e.g., screwing, crimping, soldering, however, in a preferred embodiment welding is utilized. In an especially preferred embodiment, spot welding is utilized. As shown in FIG. 3, first leg 10 has a proximal end 11, a distal end 12, and defines a longitudinal bore 13. Second leg 15 has a proximal end 16, a distal end 17, and defines a longitudinal bore 18. The stem 20 has a proximal end 26, a distal end 27, and defines a longitudinal bore 28. FIG. 4 shows the first leg 10, second leg 15, and stem 20 just prior to assembly. To form the bifurcated stent 5, the proximal end 11 of first leg 10 and the proximal end 16 of second leg 15 are joined to the distal end 27 of the stem portion 20 so that the longitudinal bores 13, 18, and 28 are in communication with each other. FIG. 5 is an end view and FIG. 6 is a side view of the assembled apparatus.

[0011] FIG. 11 shows a second bifurcation stent not forming part of this invention. The stent 50 is provided with a first leg 55 and a second leg 60 attached to a stem portion 65. The bifurcation stent 50 is formed from a first sheet 70 and a second sheet 75 as shown in FIG. 7. The stent sheets 70 and 75 may be patterned or etched with perforations forming a variety of patterns as specific applications dictate to achieve the expandable features required as previously discussed. The sheets 70 and 75 are substantially flat and have a predetermined length and width. First sheet 70 has a first edge 71, a second edge 72, a third edge 73 and a fourth edge 74. The second sheet 75 has a first edge 76, a second edge 77, a third edge 78, and a fourth edge 79. To form the legs of the stent a portion of edge 72 is rolled towards a portion of edge 74 and a portion of edge 77 is rolled towards a portion of edge 79. Demarcation points 80, 81, 82, and 83 are selected on sheets 70 and 75 as shown in FIG. 8. These demarcation points 80, 81, 82, and 83 are selected to meet the requirement of specific applications and may be adjusted depending upon the length re-

quired for legs 55 and 60 and the length required for stem 65. Demarcation points 80 and 81 that are equidistant from edges 73 and 71 and demarcation points 82 and 83 that are equidistant from edges 76 and 78 will result in a stent in which the legs 55 and 60 have a length that is substantially equal to stem portion 65. If the demarcation points are selected to be closer to edges 73 and 78 than to edges 71 and 76 the stem will have a length that is greater than the length of each of the legs. If the demarcation points are selected to be closer to edges 71 and 76 than to edges 73 and 78, each of the legs 60 and 65 will have a length that is greater than the length of the stem 65. In a preferred embodiment, however, the demarcation points 80, 81, 82, and 83, are selected so that proximal edges 72'', 74'', 77'', and 79'' are about 1/3 the length of edges 72, 74, 77, and 79. As shown in FIG. 8, demarcation point 80 divides edge 72 at approximately its midpoint into a distal edge 72' and a proximal edge 72''. Demarcation point 81 divides edge 74 at approximately its midpoint into a distal edge 74' and a proximal edge 74''. Demarcation point 82 divides edge 77 at approximately its midpoint into a distal edge 77' and a proximal edge 77'' and demarcation point 83 divides edge 79 at approximately its midpoint into a distal edge 79' and a proximal edge 79''.

[0012] To form the stent, edge 72' is connected to edge 74' via weld run 90 to form first member 95 having a first leg portion 55 and a first stem half 65' as shown in FIG. 9. Edge 77' is connected to edge 79' via weld run 91 to form second member 100 having a second leg portion 60 and a second stem half 65''. As previously discussed, the edges may be connected in a variety of ways well known to those skilled in the art. FIG. 10 shows the first member 95 and the second member 100 shown in FIG. 9 in alignment just prior to assembly. To produce the bifurcated stent 50 shown in FIGS. 11 and 12, edge 72'' is connected to edge 79'' via weld run 92 and edge 74'' is connected to edge 77'' via weld run 93 so that first stem half 65' and second stem half 65'' form stem 65. FIG. 12 is a cross-sectional end view of the stent shown in FIG. 11.

[0013] In the embodiment shown in FIG. 7, sheets 70 and 75 are squares or rectangles. The sheets 70 and 75 are not limited to this configuration, however, as shown in FIG. 7B. FIG. 11B shows a bifurcation stent manufactured using the sheets 270 and 275 shown in FIG. 7B. The stent 250 is provided with a first leg 255 and a second leg 260 attached to a stem portion 265. The bifurcation stent 250 is formed from a first sheet 270 and a second sheet 275 as shown in FIG. 7B. The stent sheets 270 and 275 may be sized and etched as previously discussed. As shown in FIG. 7B, first sheet 270 has a first edge 271, a second edge 272, a third edge 273, a fourth edge 274, a fifth edge 275, and a sixth edge 276, a seventh edge 146, and an eighth edge 147. The second sheet 275 has a first edge 277, a second edge 278, a third edge 279, a fourth edge 280, a fifth edge 281, a sixth edge 282, a seventh edge 148, and an eighth edge 149. As shown in FIG. 9B, edge 274 is connected to edge 276 via weld run 290 to form first member 295 having a first leg portion 255 and a first stem half 265'. Edge 280 is connected to edge 282 via weld run 291 to form second member 300 having a second leg portion 260 and a second stem half 265''. As previously discussed, the edges may be connected in a variety of ways well known to those skilled in the art. FIG. 10B shows the first member 295 and the second member 300 shown in FIG. 9B in alignment just prior to assembly. To produce the bifurcated stent 250 shown in FIGS. 11B and 12B, edge 272 is connected to edge 149 via weld run 292 and edge 278 is connected to edge 147 via weld run 293 so that first stem half 265' and second stem half 265'' form stem 265. FIG. 12B is a cross-sectional end view of the stent shown in FIG. 11B. FIG. 12C shows an alternative pattern that may be used in place of the patterns shown in FIGS. 7 and 7B.

[0014] The embodiment of this invention comprises two portions which are deployed serially in two steps and assembled within the patient to form a bifurcated stent. FIG. 13 shows stem and first leg portion 110 provided with a longitudinal bore 131 and having a proximal end 115 defining a stem portion 125 and a distal end 120 defining a first leg portion 130. Second leg portion 140 is provided with a longitudinal bore 132 and has a proximal end 145 and a distal end 150. Stem and first leg portion 110 and second leg portion 140 may be sized and patterned or etched as previously discussed. A branch aperture 135 is disposed between proximal end 115 and the distal end 120 of stem and first leg portion 110. The branch aperture 135 is sized to receive second leg portion 140 and is adapted to engage and secure the second leg portion 140 when it has been expanded within the branch aperture 135. Second leg portion 140 is sized and adapted to engage and be secured into branch aperture 135 upon expansion. FIGS. 14 to 21 show how the bifurcated stent is assembled within a bifurcated lumen. As shown in FIGS. 14 to 21, the area to be treated is a bifurcated lumen having a first or trunk lumen 190 and a second or branch lumen 195. As shown in FIG. 14, a first wire 155 is introduced into the trunk lumen 190 and a second guide wire 156 is introduced into the branch lumen 195. As shown in FIG. 15, a balloon expandable stem and first leg portion 110 is disposed on the tip of a first balloon catheter 170 so that the balloon 175 is disposed within longitudinal bore 131. A second balloon catheter 171 is then introduced into longitudinal bore 131 of stem and first leg portion 110 and is advanced so that the balloon 176 is disposed within aperture 135. First catheter 170 is mounted on first guide wire 155 and second catheter 171 is mounted on second guide wire 156. As shown in FIG. 16, the unexpanded stem and first leg portion 110 is guided to the area to be treated so that first leg portion 130 is disposed within trunk lumen 190 and branch aperture 135 communicates with branch lumen 195. Guide wire 156 facilitates the orientation of the branch aperture 135 with the

branch lumen 195. The size of the conventional catheters and balloons is not to scale and details well known to those skilled in the art have been omitted for clarity. Balloon 175 is inflated which causes the stem and first leg portion 110 to expand, as shown in FIG. 17, to secure it in the desired position. After expansion, the external wall of stem and first leg portion 110 would contact the interior walls of trunk lumen 190, however, a gap has been intentionally left for clarity. The balloon 175 on first catheter 170 is left inflated and the balloon 176 on second catheter 171 is then inflated to enlarge the branch aperture 135 as shown in FIG. 18. As the branch aperture 135 is enlarged a portion of the stent defining the branch aperture 135 is pushed outward to form a branch securing lip 180.

[0015] Balloons 175 and 176 are deflated, second catheter 171 is withdrawn, and second guide wire 156 is left in place in the branch lumen 195. Second leg portion 140 is then applied to second catheter 171 so that balloon 176 on second catheter 171 is disposed in longitudinal bore 132 and second catheter 171 is then applied to second guide wire 156. Second leg portion 140 is then guided to, and introduced into, the longitudinal bore 131 of the stem and first leg portion 110 and is advanced and passed through branch aperture 135 so that the distal end 130 of the second leg portion 140 protrudes into the branch lumen 195 and the proximal end 145 communicates with longitudinal bore 131, as shown in FIG. 19. The balloon 176 on second catheter 171 is partially inflated and the balloon 175 on first catheter 170 is then partially inflated to a pressure substantially equal to the pressure in balloon 176. Both balloons 175 and 176 are then simultaneously inflated to substantially equal pressures. As shown in FIG. 20, inflation of the balloon 176 on second catheter 171 causes second leg member 140 to expand so that its external walls engage and are secured to the area surrounding aperture 135. Inflation of the balloon 175 on the first catheter 170 prevents stem and first leg portion 110 from collapsing when balloon 176 is inflated. After expansion, the external walls of second leg 140 would contact the inner wall of lumen 195, however, a gap has been intentionally left for clarity. The balloons 175 and 176 are deflated, catheters 170 and 171 and guide wires 155 and 156 are withdrawn, and the assembled bifurcated stent 160 is left in place as shown in FIG. 21.

Claims

1. A system for forming a bifurcated stent, comprising a first expandable tubular portion (110) and a second expandable tubular portion (140), the first tubular portion (110) having a longitudinal bore (131), a single proximal end (115) defining a stem portion (125), a single distal end (120) defining a first leg portion (130), and a branch aperture (135) formed in a sidewall of the first tubular portion (110) and disposed between the proximal end (115) and the distal end (120), said branch aperture (135) communicating with said longitudinal bore (131),
wherein the second tubular portion (140) is adapted to be advanced through and to protrude beyond said branch aperture (135) to form a second leg, wherein the second tubular portion (140) is sized and adapted to engage and to be secured into the branch aperture (135) upon expansion.

2. A system for forming a bifurcated stent according to claim 1, wherein the branch aperture (135) is suitable to be pushed outward to form a branch securing lip (180).

3. A system for forming a bifurcated stent according to claim 1 or 2, wherein the stem portion (125), the first leg portion (130) and the second leg portion (140) are patterned or etched.

4. A bifurcated stent comprising a first expandable tubular portion (110) and a second expandable tubular portion (140),
the first tubular portion (110) having a longitudinal bore (131), a single proximal end (115) defining a stem portion (125), a single distal end (120) defining a first leg portion (130), and a branch aperture (135) formed in a sidewall of the first tubular portion (110) and disposed between the proximal end (115) and the distal end (120), said branch aperture (135) communicating with said longitudinal bore (131),
the second tubular portion (140) being advanced through and protruding beyond said branch aperture (135) to form a second leg, wherein the second tubular portion (140) is engaged and secured into the branch aperture (135) by expansion.

5. A bifurcated stent according to claim 4, wherein the branch aperture (135) is pushed outward to form a branch securing lip (180).

6. A bifurcated stent according to claim 4 or 5, wherein the stem portion (125), the first leg portion (130) and the second leg portion (140) are patterned or etched.

Patentansprüche

1. System zum Formen eines gabelförmigen Stents, aufweisend einen ersten ausdehnbaren, rohrförmigen Abschnitt (110) und einen zweiten ausdehnbaren, rohrförmigen Abschnitt (140), wobei der erste rohrförmige Abschnitt (110) eine Längsbohrung (131) aufweist, ein einziges proximales Ende (115), welches einen Rumpfabschnitt (125) bestimmt, ein einziges distales Ende (120), welches einen ersten Beinabschnitt (130) bestimmt, und eine Abzwei-

gungsöffnung (135), welche in einer Seitenwand des ersten rohrförmigen Abschnittes (110) ausgebildet und zwischen dem proximalen Ende (115) und dem distalen Ende (120) angeordnet ist, wobei die Abzweigungsöffnung (135) mit der Längsbohrung (131) in Verbindung steht,
wobei der zweite rohrförmige Abschnitt (140) geeignet ist, durch die Abzweigungsöffnung (135) geführt zu werden und über diese Abzweigungsöffnung vorzustehen, um ein zweites Bein zu bilden, wobei der zweite rohrförmige Abschnitt (140) so bemessen und angepasst ist, um bei Ausdehnung in die Abzweigungsöffnung (135) einzugreifen und in dieser befestigt zu sein.

2. System zum Formen eines gabelförmigen Stents gemäß Anspruch 1, wobei die Abzweigungsöffnung (135) geeignet ist, nach außen gestoßen zu werden, um eine Abzweigungsbefestigungslippe (180) zu bilden.

3. System zum Formen eines gabelförmigen Stents gemäß Anspruch 1 oder 2, wobei der Rumpfabschnitt (125), der erste Beinabschnitt (130) und der zweite Beinabschnitt (140) gemustert oder geätzt sind.

4. Gabelförmiger Stent, aufweisend einen ersten ausdehnbaren, rohrförmigen Abschnitt (110) und einen zweiten ausdehnbaren, rohrförmigen Abschnitt (140), wobei der erste rohrförmige Abschnitt (110) eine Längsbohrung (131) aufweist, ein einziges proximales Ende (115), welches einen Rumpfabschnitt (125) bestimmt, ein einziges distales Ende (120), welches einen ersten Beinabschnitt (130) bestimmt, und eine Abzweigungsöffnung (135), welche in einer Seitenwand des ersten rohrförmigen Abschnittes (110) ausgebildet und zwischen dem proximalen Ende (115) und dem distalen Ende (120) angeordnet ist, wobei die Abzweigungsöffnung (135) mit der Längsbohrung (131) in Verbindung steht,
wobei der zweite rohrförmige Abschnitt (140) geeignet ist, durch die Abzweigungsöffnung (135) geführt zu werden und über diese Abzweigungsöffnung vorzustehen, um ein zweites Bein zu bilden, wobei der zweite rohrförmige Abschnitt (140) so bemessen und angepasst ist, um bei Ausdehnung in die Abzweigungsöffnung (135) einzugreifen und in dieser befestigt zu sein.

5. Gabelförmiger Stent gemäß Anspruch 4, wobei die Abzweigungsöffnung (135) nach außen gestoßen ist, um eine Abzweigungsbefestigungslippe (180) zu bilden.

6. Gabelförmiger Stent gemäß Anspruch 4 oder 5, wobei der Rumpfabschnitt (125), der erste Beinabschnitt (130) und der zweite Beinabschnitt (140) gemustert oder geätzt sind.

Revendications

1. Un système pour former un stent bifurqué comprenant une première partie tubulaire expansible (110) et une seconde partie tubulaire expansible (140),
la première partie tubulaire (110) possédant un orifice longitudinal (131), une unique extrémité proximale (115) définissant une partie de tige (125), une unique extrémité distale (120) définissant une première partie de branche (130), et une ouverture d'embranchement (135) formée dans une paroi latérale de la première partie tubulaire (110) et disposée entre l'extrémité proximale (115) et l'extrémité distale (120), ladite ouverture de branche (135) communiquant avec ledit orifice longitudinal (131), où la seconde partie tubulaire (140) est adaptée pour être introduite dans, et faire saillie au-delà de, ladite ouverture d'embranchement (135) pour former une seconde branche, où la seconde partie tubulaire expansible (140) est dimensionnée et adaptée pour venir en prise avec, et être assujettie dans, l'ouverture d'embranchement (135) à l'expansion.

2. Un système pour former un stent bifurqué selon la revendication 1, où l'ouverture d'embranchement (135) est propre à être poussée vers l'extérieur pour former une lèvre de sécurité de dérivation (180).

3. Un système pour former un stent bifurqué selon la revendication 1 ou 2, où la partie de tige (125), la première partie de branche (130) et la seconde partie de jambe (140) sont structurés ou gravés.

4. Un stent bifurqué comprenant une première partie tubulaire expansible (110) et une seconde partie tubulaire expansible (140),
la première partie tubulaire (110) possédant un orifice longitudinal (131), une unique extrémité proximale (115) définissant une partie de tige (125), une unique extrémité distale (120) définissant une première partie de branche (130), et une ouverture d'embranchement (135) formée dans une paroi latérale de la première partie tubulaire (110) et disposée entre l'extrémité proximale (115) et l'extrémité distale (120), ladite ouverture de branche (135) communiquant avec ledit orifice longitudinal (131), la seconde partie tubulaire (140) étant introduite dans, et faire saillie au-delà de, ladite ouverture d'embranchement (135) pour former une seconde branche, où la seconde partie tubulaire expansible (140) vient en prise avec, et est assujettie dans, l'ouverture d'embranchement (135) par expansion.

5. Un stent bifurqué selon la revendication 4, où

l'ouverture d'embranchement (135) est poussée vers l'extérieur pour former une lèvre de sécurité de dérivation (180).

6. Un stent bifurqué selon la revendication 4 ou 5, où la partie de tige (125), la première partie de branche (130) et la seconde partie de jambe (140) sont structurés ou gravés.

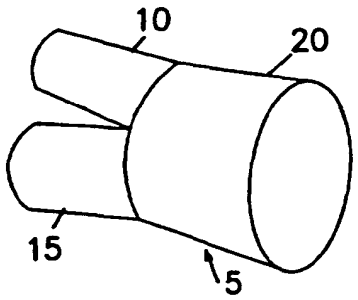

FIG. 1

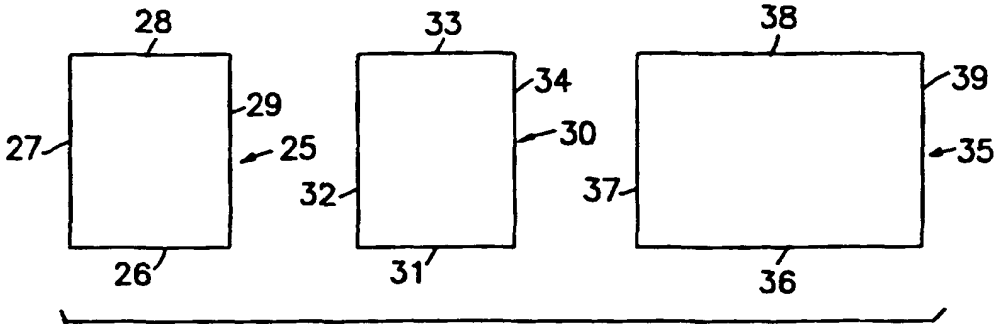

FIG. 2

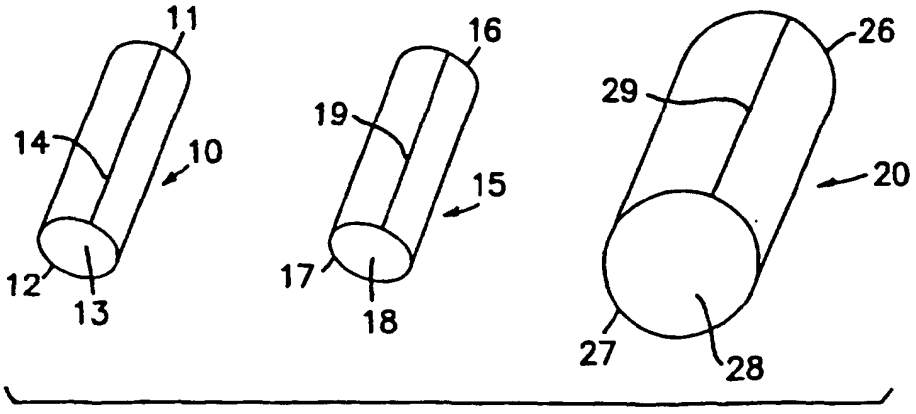

FIG. 3

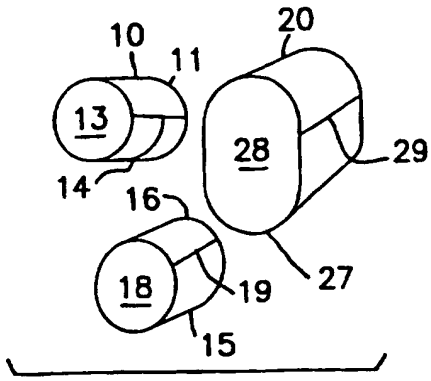

FIG. 4

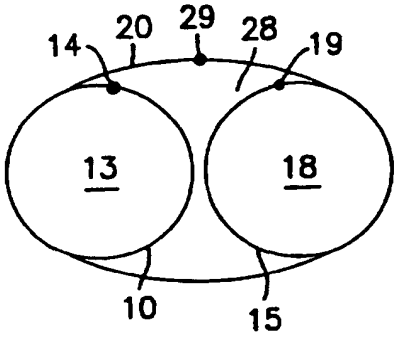

FIG. 5

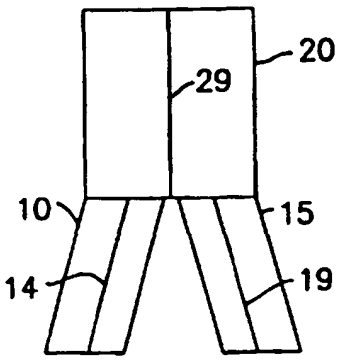

FIG. 6

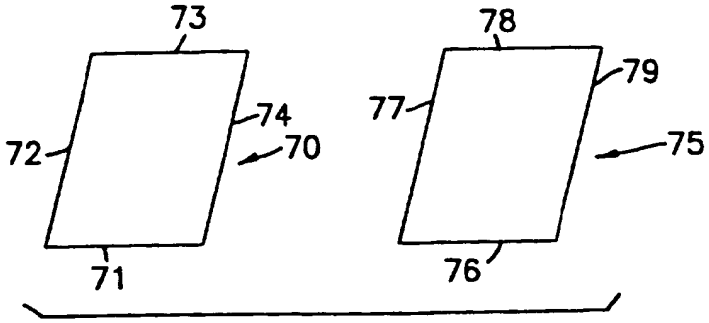

FIG. 7

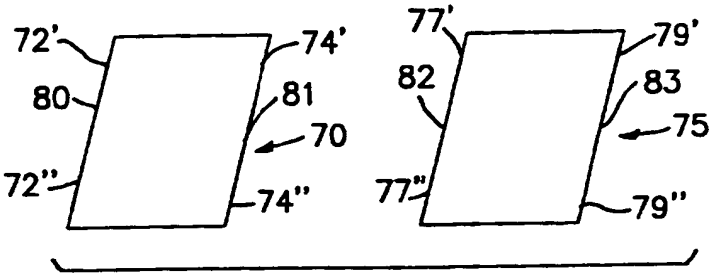

FIG. 8

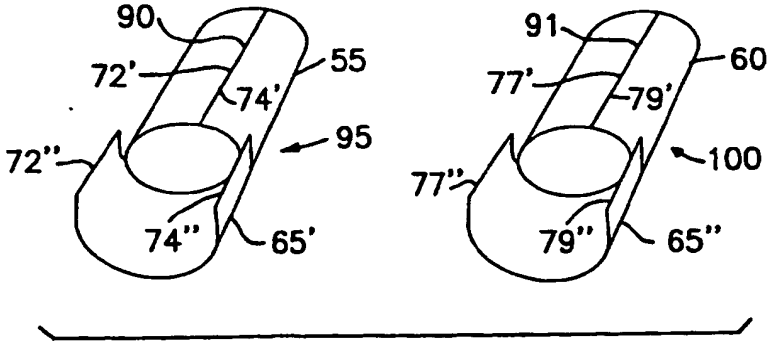

FIG. 9

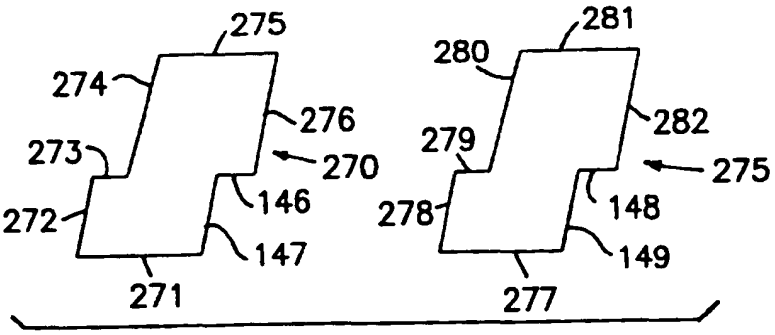

FIG. 7B

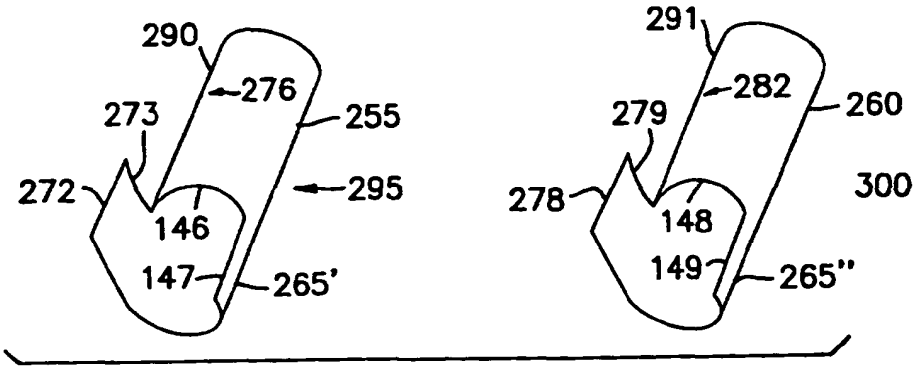

FIG. 9B

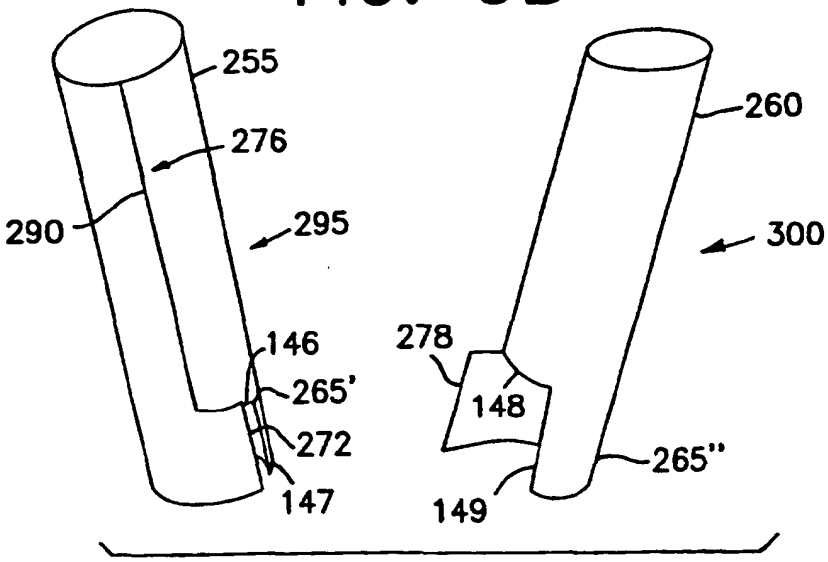

FIG. 10B

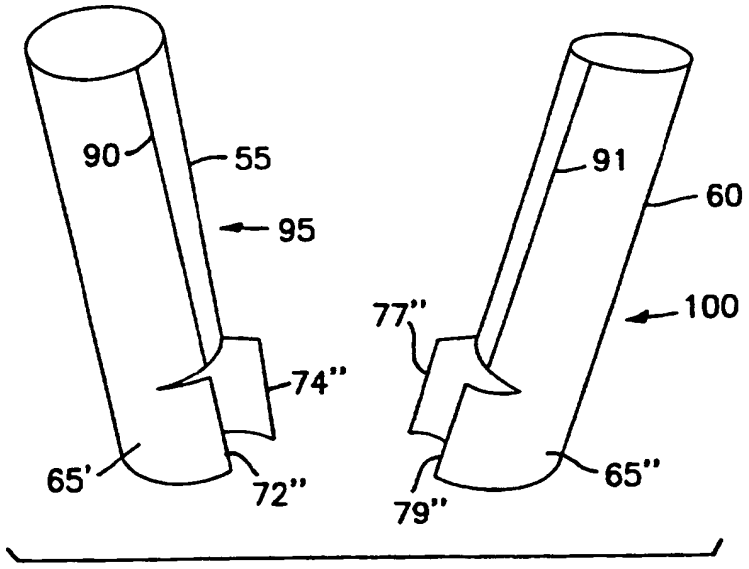

FIG. 10

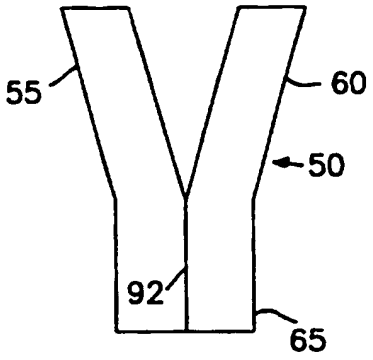

FIG. 11

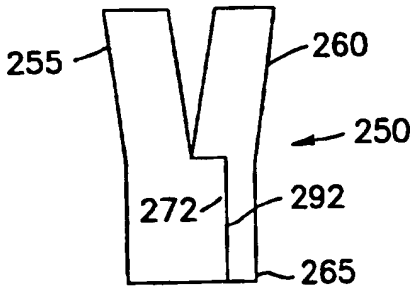

FIG. 11B

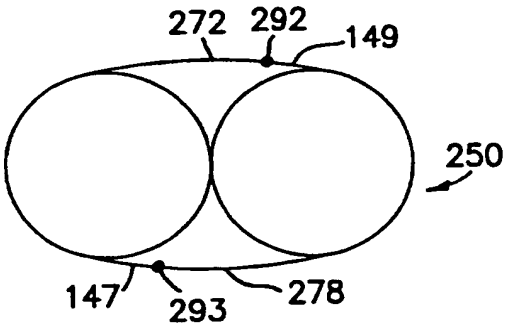

FIG. 12B

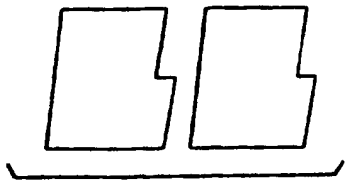

FIG. 12C

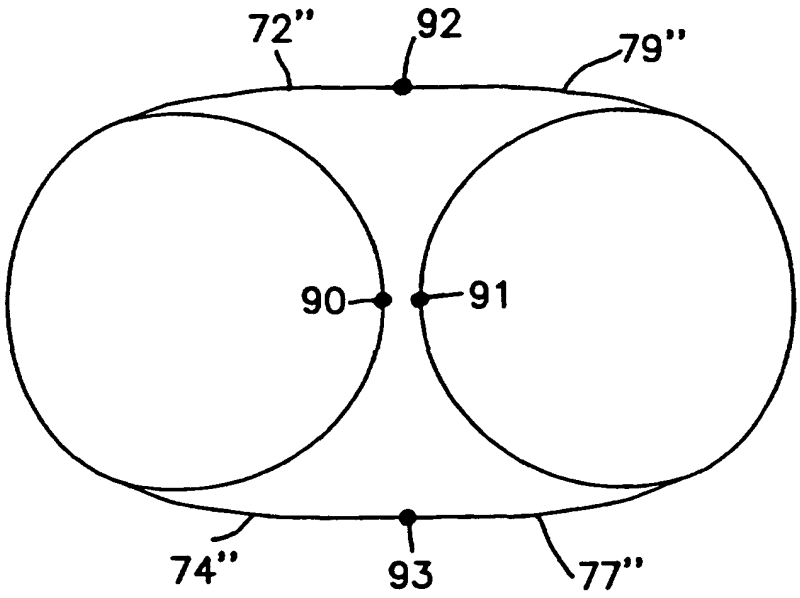

FIG. 12

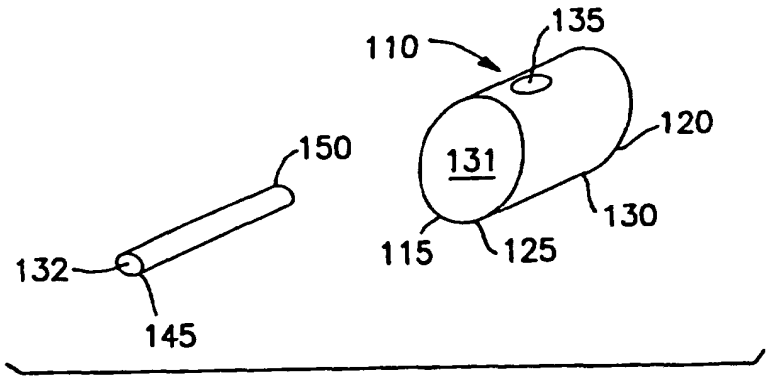

FIG. 13

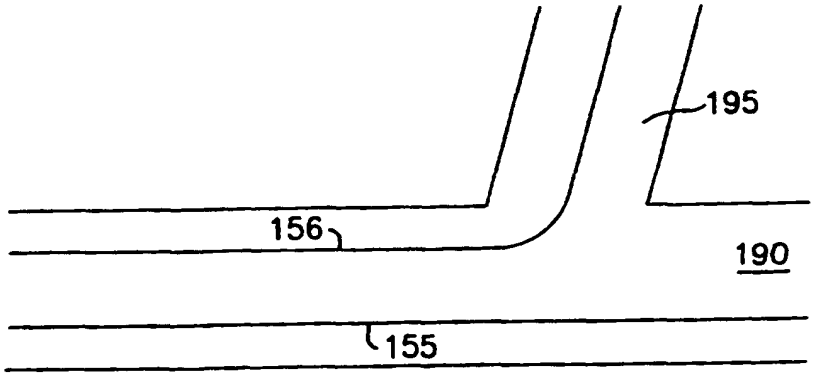

FIG. 14

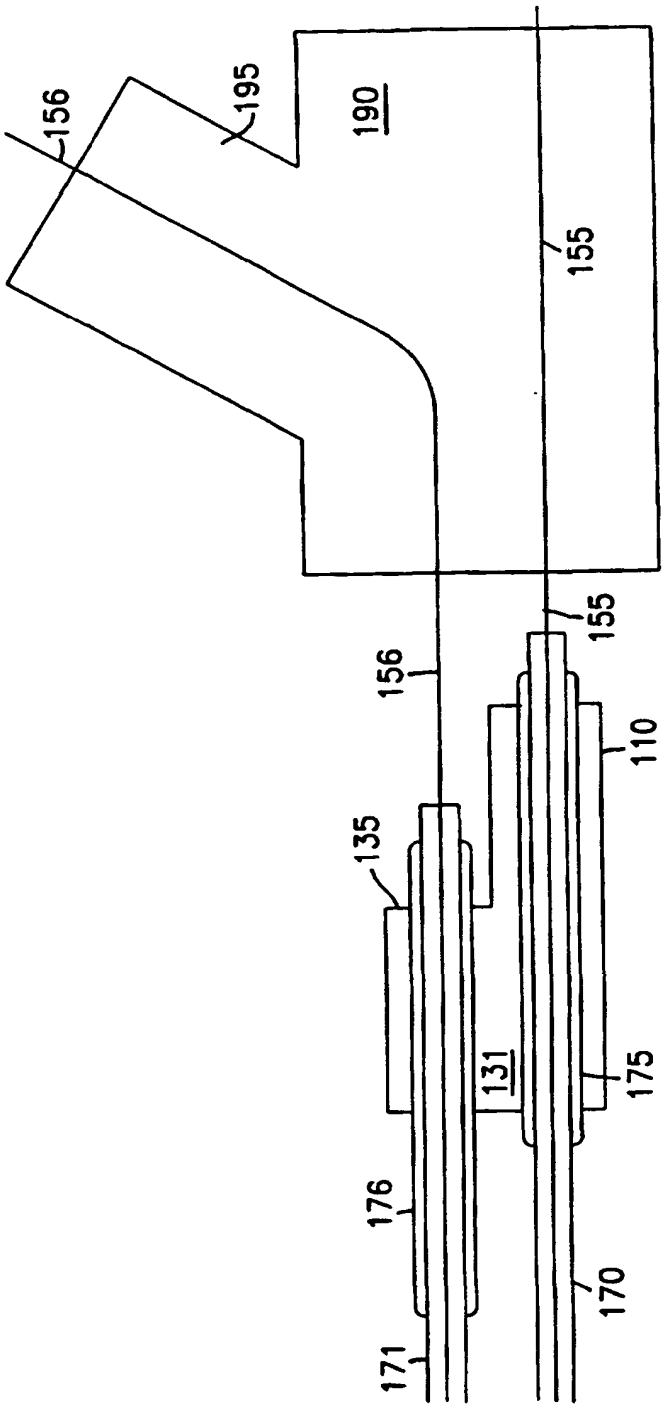

FIG. 15

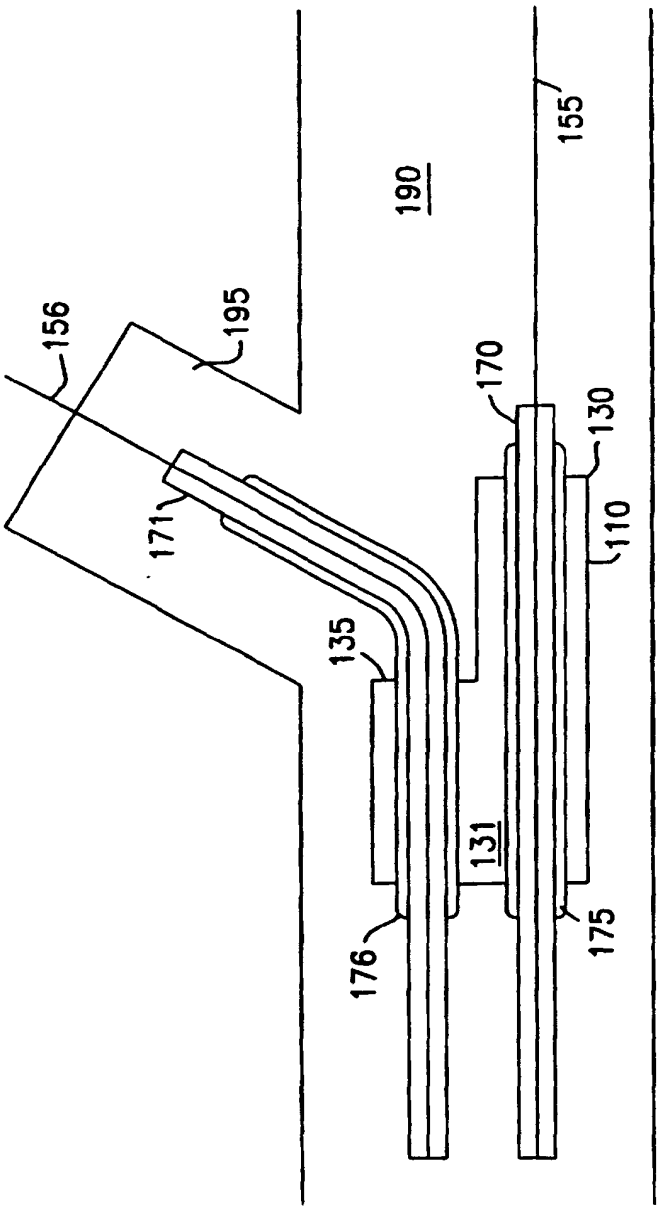

FIG. 16

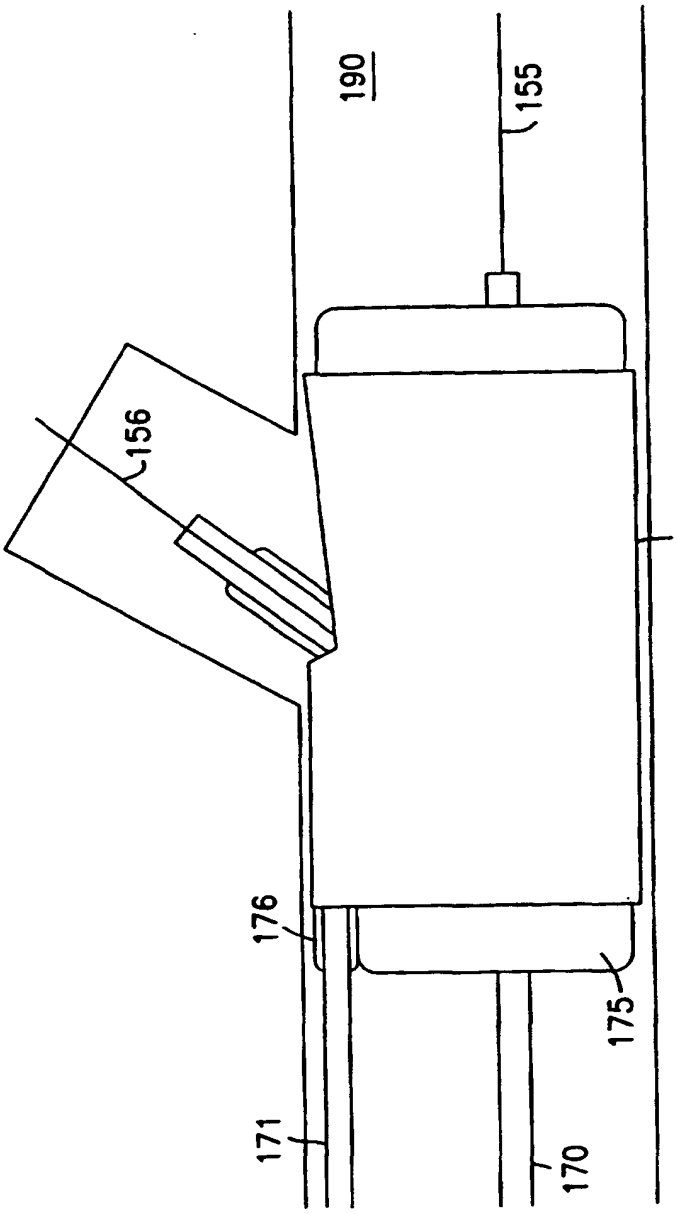

FIG. 17

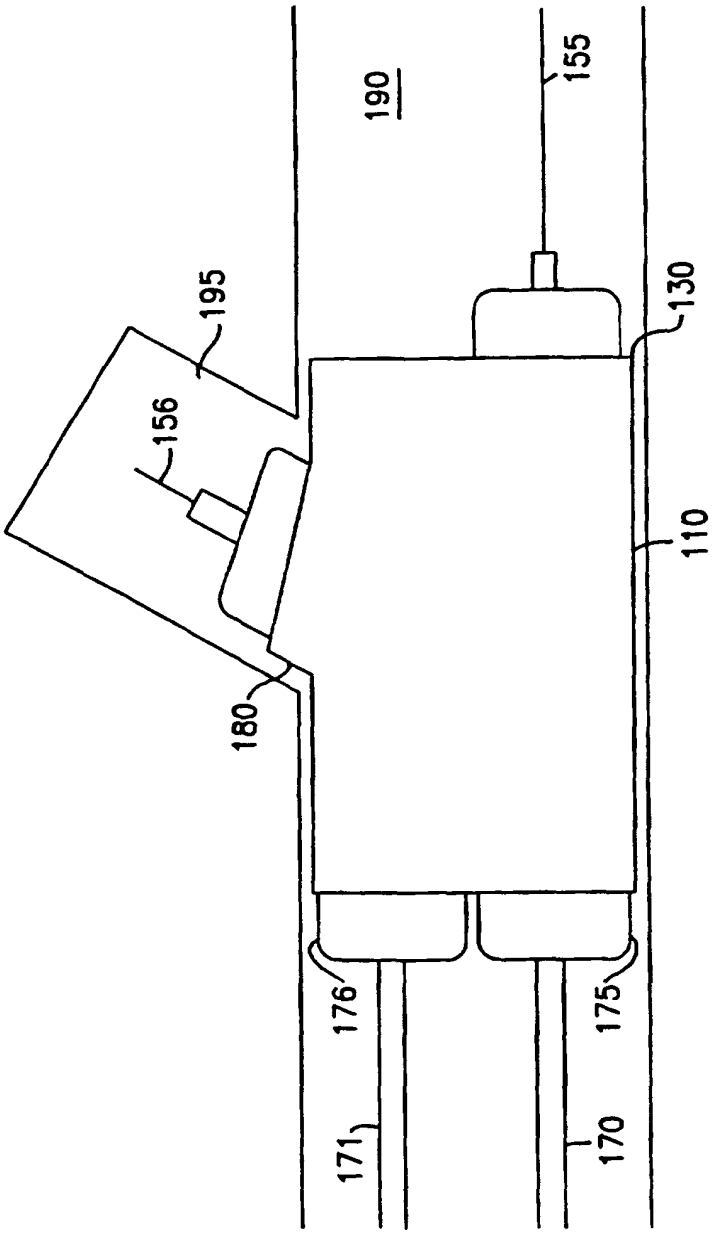

FIG. 18

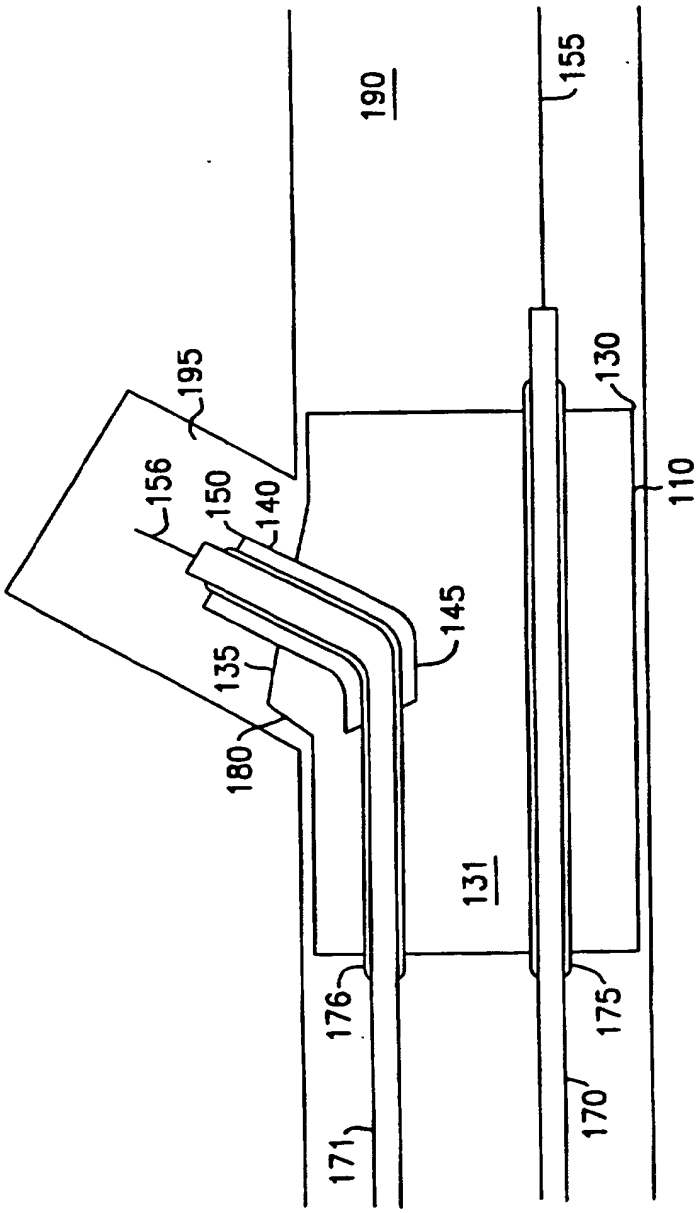

FIG. 19

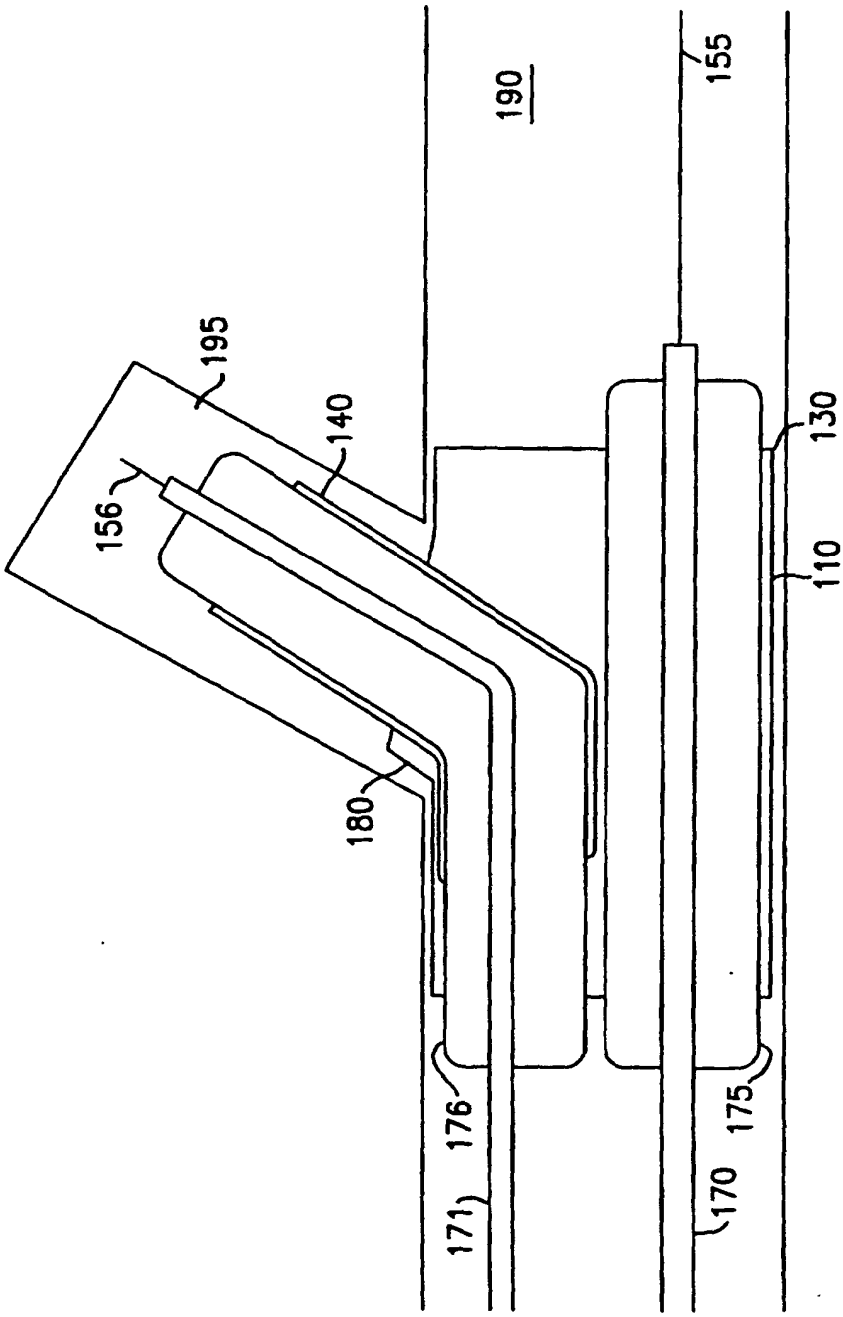

FIG. 20

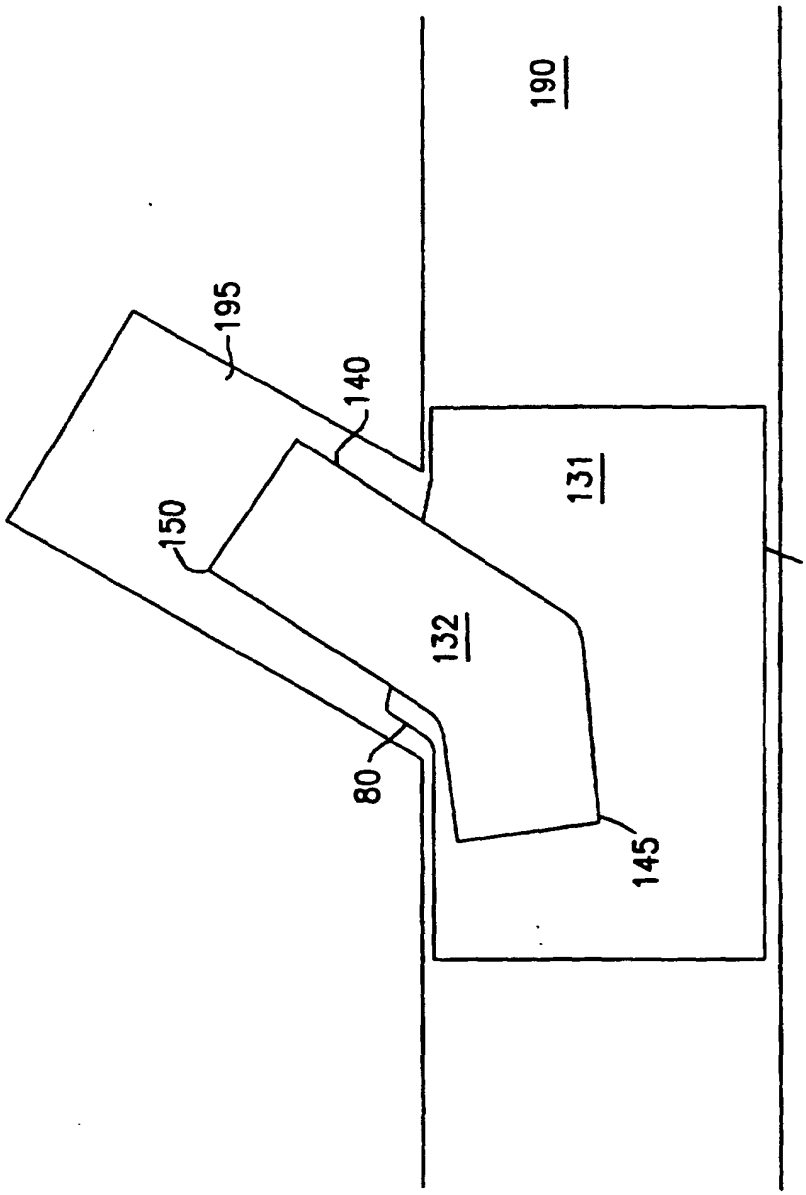

FIG. 21